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ABSTRACT

Guidelines for formally evaluating the external environment of a university are presented. The guidelines are evaluated and refined on the basis of results of an experimental environmental assessment effort at a large research university. Eleven critical tensions associated with environmental assessment are also discussed, along with theoretical and applied implications. In addition eight constraints on formal environmental analysis are discussed. An environmental assessment experiment at University of Minnesota in 1983 was undertaken to promote institutional planning. Information was collected and disseminated on general environmental issues, but without action recommendations. These efforts were qualitatively evaluated with attention to the following questions: Should universities formally assess their external environments? What should be assessed? Who should do the assessing? How should the assessment effort be organized? What should be produced? Critical tensions in environmental assessment include: credibility versus quality, issue management versus issue identification and analysis, interpretation versus information, diversity versus homogeneity, and process versus products. (SW)

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# FORMAL ASSESSMENT OF THE EXTERNAL ENVIRONMENT OF A UNIVERSITY: CONSTRAINTS AND POSSIBILITIES*

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# Formal Assessment of the External Environment of a University: Constraints and Possibilities


## Abstract

Organizational analysts are increasingly arguing that formalized environmental assessments should be initiated and integrated into strategic planning. Yet universities face several major constraints in attempting to do so: high degrees of environment/organization interpenetration, diffuse and vague goals, contesting of goals, the "bias to knowing," loose coupling, the conservative academic culture, constrained resources, and the conflict of turbulent environments with participatory governance norms. This paper presents potential guidelines for establishing formal environmental assessment in such a context, evaluates and refines those guidelines on the basis of the results of an experimental environmental assessment effort at a large research university, and identifies several critical tensions associated with environmental assessment. Theoretical and applied implications are discussed.

## Formal Assessment of the External Environment of a University: Constraints and Possibilities

The field of organization theory has been radically reshaped in the past two decades by the notion of the organization as an "open system." As Scott (1981) has stressed, "organizations are not closed systems, sealed off from their environments, but are open to and dependent on flows of personnel and resources from outside their own system" (page 22). This point has been echoed by Perrow (1979), Thompson (1967), Pfeffer and Salancick (1978), and numerous others. As an "open system," each organization must provide inducements for others to contribute to it. Without appropriate inducements, such as lower prices, attractive salaries, and valued products, the organization may prompt individuals and other organizations to direct their money, time, or energy elsewhere. In order to structure its inducements appropriately, an organization must effectively assess its external environment and respond to changes in it.[1]

The growth of this theoretical perspective has been paralleled by changes in the prescriptive management and planning literature. Increasingly, that literature has stressed the merits of a broadly-based strategic approach, featuring a knowledgeble but also intuitive environmental sensitivity in top managers (e.g., see Thomas, 1980; Peters and Waterman, 1982). Thus the ideal organization surveys its environment in general, selects certain key environmental issues, trends, and domains for concentrated tracking, and feeds useful cues into its ongoing strategic decision making.

Precisely what is environmental assessment? There are a number of answers available. Wilson (1983) has said there are two essential requirements for organizations facing uncertainty. Specifically, "one is a star to steer by (vision by the business), the other is a radar system (environmental analysis)

to pick out rocks, reefs, headlands, and clear water ahead" (page 4). Less metaphorically, the analyst who popularized the use of the term "scanning" to refer to environmental assessment (Aguilar, 1967, page 1), has argued it is "the activity of acquiring information... [It focuses on] events and relationships in a company's outside environment, the knowledge of which would assist top management in its task of charting the company's future course of action."

While all organizations assess their environments in some way, Aguilar draws a distinction between all external information the manager receives, all external strategic information the manager receives, all external strategic information the manager wants, and all external strategic information the manager needs. This distinction leads Aguilar to propose that environmental assessment can be made more efficient and effective by supplementing undirected viewing with conditioned viewing, and informal search with formal search. In a similar attempt to classify and rank the various approaches to environmental assessment, Etzioni (1968) has counseled organizations to pursue "mixed scanning," in which viewing of the general environment is blended with detailed search of the operating environment. Etzioni draws an analogy between mixed scanning and the behaviors of aerial reconnaissance pilots.

The specific characteristics of environmental assessment are matters of debate and context. Defined by exclusion, the activity is usually conceived as distinct from issues management, multiple scenario analysis, econometric forecasting, marketing analysis, internal organizational assessment, formalized planning, or values analysis (see Heydinger, 1983a; Heydinger and Zentner, 1983; Pflaum, 1983; Foresight Task Force, 1983; Aguilar, 1967). Wilson (1983) has proposed six critical characteristics of formal environmental assessment: 1) it is integrated into the decision making and planning processes, 2) it is relevant

to current and emerging issues, 3) it is holistic rather than piecemeal, 4) it is an iterative and continuous process, consisting both of generalized scanning to spot trends and targeted monitoring to track critical trends, 5) it is heuristic and exploratory rather than predictive, and 6) it balances qualitative interpretive insights with quantitative data. Aguilar (1967) has defined the activity as the systematic collection of external information in order to lessen the randomness of information flowing into the organization and thus to provide early warnings for managers of changing external conditions.

The organizational uses of environmental assessment have perhaps been most precisely studied and described by Thomas (1980), whose studies of scanning activities in various corporations have found it being used not only for mind-stretching or educational purposes for managers (e.g., as at General Mills), but also for strategic policy development (CIBA-Geigy), the development of operating plans and programs (Citicorp), and the development of a frame of reference for the annual budget (General Motor's Societal Research Group). He concludes that "broad-spectrum scanning need not be restricted to the benevolent mind-stretching variety but may be expected to have teeth as well" (page 22).

Constraints in Assessing a University's External Environment

In the abstract, the above ideas resonate with simplicity and common sense. But the less straightforward an organization's goals, technology, environment, decision processes, and structure, the more difficulties it will face in putting the ideas into action (see, for example, Stubbert, 1982). This proposition implies some daunting hurdles for educational organizations, given their often ambiguous goals and technology (Weick, 1978). Those hurdles may be highest for the university, perhaps the least straightforward of educational organizations

(Cohen and March, 1974; Baldridge, 1971, 1977). While their heterogeneous knowledge base may seem an ideal foundation for environmental assessment, it is argued here that universities face at least eight important constraints as they seek to heed the ubiquitous calls for environmental attention.

First, as Burton Clark has noted (1983), the disciplinary mode of organization in higher education tears the traditional distinction between organization and environment to shreds, "since a large array of occupationally specified slices of the 'environment' have basic representation and location within the 'organization'" (page 31). Therefore, while the various research efforts on a campus might be viewed as ongoing acts of sophisticated environmental monitoring, the relation of the environmental intelligence thus gathered to the sustenance of the organizational whole is ambiguous. Most would agree that a university is more than the sum of its semi-autonomous and often actively competing disciplinary parts, but defining its own uniquely relevant environment is a problematic exercise.

Second, that act of defining the uniquely relevant environment of a university as a whole is made even more difficult by the oft-cited vagueness and diffuseness of the university's goals (Cohen and March, 1974; Baldridge, 1977). When confusion over the true goals of an enterprise is rampant, the act of sorting the infinite noise of the world into relevant and irrelevant environmental stimuli is challenging, to say the least. In a sense, the environment of the university, as an organization granted by society a rather open-ended charge to seek and dispense knowledge, is limitless.

Third, when the goals of universities are not vague, they are often contested. The control of information flows can therefore be a source of power. The highly politicized nature of many contemporary postsecondary

institutions makes the role of information gatherer and dispenser a powerful one. Those in that role can help determine which particular issues arise in which particular forms at which particular times, and they can indirectly or directly influence who is given the right to set decision agendas on campus (see Baldridge, 1977). In the early 1970's, controversy frequently arose over the proper organizational location of Institutional Research offices (e.g., see Dressel, 1971). Those believing the offices should be made an action-oriented part of the executive staff came into direct controversy with those favoring a more neutral organizational role. The comparable controversy of the 1980's might be over the structuring and staffing of the environmental assessment effort.

Fourth, universities as organizations are afflicted with a "bias for knowing," to paraphrase Peters and Waterman (1982). The impulse for foolishness, intuitive action, speculation, and future-gazing is often quashed by the restrained, rationality-oriented culture of the academic setting. Yet such impulses seem necessary not only for profitably using environmental cues, but also for establishing and empowering intensive environment-watching efforts in the first place. Strategically oriented environment-watching, according to its proponents, requires paying attention to more than the latest statewide high-school enrollment figures or the most recent appropriations data for federal financial aid. It often requires the trusting of hunches, the tracing of hints in obscure, non-academic publications (e.g. "futurist" literature), and the aesthetic effort of piecing together "a story" out of disparate quantitative and qualitative clues (Peters and Waterman, 1983; Cope, 1981a; Keller, 1983).

Fifth, the loose coupling within most universities precludes the timely, organization-wide environmental responsiveness possible in other kinds of

organizations. Loose-coupling can serve organizations well by allowing localized adaptations to changes, but it also can be a drain when institution-wide response to an environmental change is dictated. Weick (1978) has argued that loose coupling allows both archaic traditions and innovative improvisations to be preserved. In universities, the former may be rather more likely to be found than the latter due to the resistance of departmental units both to change imposed from above (Clark, 1983) and to efforts to involve them intimately in institutional planning (Palola et al., 1971). Such characteristics of universities may limit staff acceptance, and the eventual odds of success, of institution-wide environmental assessment (why bother, if top administrators have only limited capability to affect the directions of the organization as a whole?).

Sixth, and similarly, the cultures and histories of universities may make them especially resistant to change. Faculty frequently refer to the stability of the moral task of the university and to the inadvisability of a "consumer" orientation on the part of the citadel of reason (Riesman, 1980; Keller, 1983; Cope 1981b). Environmental assessment, however, may be portrayed in effect as a conscious seeking of change. At the least, it involves a seeking of improved adaptability to external change. As such, it represents a challenge to the status quo. Those contented with the status quo may tend to be discontented with the establishment of formalized environmental assessment.

Seventh, environmental monitoring can be time-consuming and costly. Major corporations that have established formal environmental scanning and monitoring programs have found that substantial investments of time are required to do it well. For example, in order to better know its potential consumers,

Sears monitors over 100 social, cultural, economic, political and technological trends in over 100 periodicals, and a Minneapolis agri-business consulting firm routinely monitors over 700 periodicals and over 20 issue areas (personal communications with the authors, 1983). Universities rarely have the personnel for such intensive and extensive efforts. By necessity, assessment is likely to become the responsibility of a shifting pool of faculty and staff working on a part-time or volunteer basis.

Eighth, the environments of many universities are turbulent (Baldridge, 1971), and this turbulence may conflict with dominant governance norms. Turbulence precludes stable knowledge and thus suggests a need for timely assessment and action. Yet time is a scarce resource among both faculty and staff, and institutions such as research universities tend to have preferences for participatory governance (Clark, 1983; Baldridge and Okimi, 1982). These value systems are deeply held and can imply a need for environmental intelligence to be widely disseminated prior to decision making. This flies in the face of the demands of turbulent environments.

Despite these eight constraints on formal environmental analysis, Kotler and Murphy (1981), Keller (1983), Cope (1981a), and a number of others have argued that environmental assessment is a critical first step in university strategic planning. Given an inclination to proceed, one must attempt to blend the exuberant literature of "the strategic management revolution" with the bittersweet realities of contemporary university organization. It would seem that the success of environmental assessment in higher education depends upon its being not only intuitive, creative, and strategically oriented, but also open, representatively staffed, highly cost-effective, well-placed organizationally, and extremely sensitive to the organization's political context. From this

somewhat intimidating perspective, a set of hard questions confronts administrators interested in initiating this effort: What will be assessed? Who will do it? How will the effort be organized? What will be its products? These questions guided the case study analysis described below.

## The Case Study

This qualitative evaluation is based on early results of an environmental assessment experiment[2] initiated by the University of Minnesota in July, 1983. The University of Minnesota, Twin Cities is one of the largest campuses in the world with over 45,000 students and a wide range of academic programs and professional schools. The experiment, in the form of the Experimental Team for Environmental Assessment (ETEA), is being led by the second author of the paper; the first author has been a participant and observer in the team since its formation.

Historical Context of the ETEA. The activities discussed in this paper were not the first effort by the University of Minnesota to integrate formal environmental assessment into university planning. In the year preceding this experiment, the central administration commissioned special papers on critical external concerns from selected faculty and staff members. Two of the commissions were for lengthy treatments of pressing issues: the dean of the graduate school wrote on "developing fields of knowledge," and a faculty expert wrote on "the Minnesota economy in the year 2000." Four administrators were asked to write shorter treatments of developing issues in the society, technology, the economy, and the polity.[3] These six papers were used as background information for the strategic planning cycles in 1982-83 and 1983-84.

Stated Objectives of the ETEA. The Experimental Team for Environmental

Assessment was seen by the Office of the Vice President for Academic Affairs as a vehicle for coordinating, systematizing, and intensifying the University's environmental viewing. Its initiation in the summer of 1983 represented an attempt to "embrace uncertainty." The team was to confront the unpredictability of the future and the "fuzziness" of the contemporary environment with the objective of better delineating threats and opportunities (see Heydinger, 1983a,b). The effort was to 1) inform the President's institutional planning activities, 2) provide background information for institutional planning themes and task forces, 3) expand the perspectives of university planners, 4) reduce the chances of overlooking critical issues, and 5) produce environmental scenarios to aid planning.

From the beginning the effort was seen as separate from, but closely linked to, "issues management." The ETEA was to collect, organize, and disseminate information on specific issues as well as the general environment, but it was not to provide action recommendations (Heydinger, 1983a,b). The group was thus to engage both in broadly defined scanning activities and in specific tracking activities and to pursue neutrality in both kinds of formal enviromental assessment activities.

It is clear that the formation of the ETEA was not meant to imply a kind of environmental determinism regarding the future of the University. Instead, the scanning and tracking information was to be used as a resource: "Successful institutions will be those which are able to broaden their strategic vision and which ride the tides of change while not sacrificing those educational principles they deem important. To do so, it is essential to look beyond our traditional organizational boundaries for ideas and information" (Heydinger, 1983b, page 5). Some have suggested that a university's adoption of environmentally

aware strategic planning represents an abandoning of abstract ideals regarding what the university should be (e.g., see Young, 1981). No such intention was evident at the University of Minnesota as the ETEA began its work.

Composition of the ETEA. The group was composed[4] of seven middle-level and junior administrators, one research fellow, and one junior faculty member (the first author). All are white and U.S. born. Most are Midwesterners by birth. Two of the nine are women. The group spans ten years in age, from the early thirties to the early forties. The team was chosen by the second author, the Assistant to the Vice President for Academic Affairs, on the basis of both personal characteristics and organizational position. Most of the team have doctorates in the social sciences, none in the hard sciences; one team member is an attorney. None of the nine ETEA members had any pressure from superiors to join the team. Their participation has been entirely voluntary.

The First Eight Months of ETEA. Since July, 1983, the ETEA has met roughly biweekly. These meetings have been notable for lively, intensive discussions of potential issues (often using as starting points short issue reports prepared by members), and for lengthy, ongoing debates on how best to organize the environmental assessment efforts. In its early stages, the group began an ongoing process of constructing and refining a list of critical issues for intensive tracking by the membership. That evolving list of twenty to thirty issues (e.g., electronic publishing, changing teenage values) continues to provide the organizing framework for the group's activities in 1984.

On October 31 the group disseminated its only formal product to date: a written report on the growing controversy over the use of animals in research. This four-page report was sent to the Associate Vice President for Academic Affairs under a two-page cover letter. The cover letter stressed four methodol-

ogical points: 1) the appropriate focus of ETEA is environmental assessment, not "issues management;" 2) there is a possibility of "creating" an issue by paying attention to it; 3) ETEA is comprised of lay people oriented to spotting an issue, not experts analyzing it, and 4) ETEA was uncertain as to whom it should send its products.

The report, entitled "Emerging Issues: The Use of Animals for Research," was well-received. It was widely circulated among top adminstrators and the Board of Regents. It was not, however, alone. The flurry of press reports on the "animal rights" issue in the latter half of 1983 made the report only one of several documents being considered in the debate among university leaders.[5] In such an environment, attaching independent effects to the experimental team's first efforts is difficult. Nonetheless, there was no evidence of either distrust or ignoring of the group, its perspectives, or its report. The report seemed to form a useful adjunct but was not a pivotal element in the debates and decisions that ensued on campus.

As of February 15, 1984, the group had produced no other reports. After the release of the animal rights report, discussions returned to selecting the most critical issues for stepped-up tracking and eventual report generation. Discussions on the methodology of the group also returned to prominence with the institution of formal reading assignments being considered as a supplement to the group's more informal efforts to track its list of core issues.

Research Design

With this history of the evolution of the ETEA as a backdrop, the next section of this paper contains a qualitative evaluation of these efforts in environmental assessment. The data for this evaluation are from three sources: 1) reports, memos, and discussions relating to the group, 2) structured interviews

with each of the group members, and 3) a structured interview with the primary administrative consumer of the group's products. The interview structure was guided by the concerns facing those considering the initiation of a scanning effort. It featured six open-ended questions: 1) whether to assess the environment, 2) what to assess, 3) who should do the assessing, 4) how should the assessing be organized, 5) what should the products of assessment be, and 6) how well has the experiment gone so far?

Numerous criticisms may be raised regarding the validity of evaluations conducted by people performing the work being evaluated. We recognize these; yet we have made a concerted effort to make a valid, objective presentation. While others were consulted regarding the factual bases of our inferences, the ultimate responsibility for qualitative judgments lies with the authors alone.

Presentation of the "findings" from this case are organized into the six essential questions delineated above. To further organize the discussion, the findings for four questions are preceeded by our initial hypotheses regarding the optimal approach for establishing environmental assessment in the university. These hypotheses themselves are as much products of the ETEA as guiding frameworks for it. They were generated by the authors in the early months of the effort, on the basis of organizational theory, the eight constraints noted at the outset of this paper, the literature on strategic planning in higher education, and the very early meetings of the ETEA. As such, the hypotheses formed reference points for the interviews and analysis conducted in later months. Respondents in turn reacted to the interview questions in ways that informed revision of the existing hypotheses and generation of new ones. The text that follows is aimed at portraying that ongoing interaction of theory and practice. It is our intention that this format will add a significant new dimension to the

literature on environmental assessment. That literature, in our judgment, is long on prescription, long on description, and short on analytical insight.

Hypotheses and Findings

Should Universities Formally Assess Their External Environments? None of the interviewed sample believed that environmental assessment should be abandoned. Despite significant differences over process, staffing, and substance, the effort itself was judged worth continuing by all concerned. The one written product of the group was mentioned by some as organizationally valuable and a clear indication of the potentials of assessment efforts. Several respondents mentioned the pressing need for all administrators to think in environmentally sensitive ways and saw a role for this group as an ongoing prod in that direction, beyond its role as informant and interpreter regarding specific external developments.

What Should Be Assessed? Four hypothesized guidelines were formulated by the authors in the early stages of the ETEA. First, frame the assessment effort in broad terms, i.e., consider socio-cultural, technological, economic, and political issues of possible relevance for "the conceivable university," rather than only those issues and trends of probable relevance for the institution as it exists today. Second, identify issues and trends of campus-wide significance. Do not focus on matters of only parochial, disciplinary significance. Third, do not reject issues or trends solely because they arise mainly out of one discipline's "turf," e.g., computer science or biochemistry. Fourth, be selective in the issues and trends picked for the most intensive monitoring. Identify at first a broad typology of domains for scanning (e.g., quality/equality concerns, the information technology revolution, etc.), as discussed above, then pick specific, especially pressing, subtopics for intensive tracking

(e.g., trends in computer access among various secondary school populations, recent changes in the publishing industry). Undoubtedly, resource constraints will not permit a full-blown effort in each specific area of interest.

While no one subsequently interviewed disagreed significantly with any of these four initial hypotheses, the interviews suggested that the true difficulties of subject matter were not touched upon by the generally phrased guidelines. The primary disagreement of the respondents focused on the precise "location" of the university's environment. One is reminded of the classic line from the Pogo comic strip (slightly paraphrased), "We have met the environment and he is us." On one side of the issue were those who believe one need only look inside the university to see its environment. Because of the extensive interpenetration of the university by its environment, there may be little reason to scan in the usual sense. Instead, students, faculty, and staff may daily be providing the raw material to be scanned, if only the environmental assessors would look in the right places and in the right ways. Opposed to this perspective were those who believe strongly in the need to look beyond the institution's boundaries in order to understand its present and anticipate its future. They argue that the environment is unknowable from largely "local" information sources. One of the followers of this perspective cautioned against the inevitable temptation of highly educated administrators and faculty to scan only "inside their heads."[6]

A milder topic of disagreement came over the question of establishing a formal assessment approach, such as individual reading assignments based on the "STEP" approach (social, technological, economic, and political/legal categories, respectively; see Cope, 1981a). Specifically, 1) should everyone scan for the same general issues? 2) should everyone scan specifically assigned materials or

simply follow their own reading pattern? 3) should formal criteria be established for the acceptance of an issue, such as those generated through a probability/impact matrix? (see Cope, 1981a), and 4) has the group's scanning and tracking been focused too much or too little on "social" factors, as opposed to matters of technology? On the latter point, there was general agreement that the group's concerns thus far had been largely socioeconomic, but disagreement over whether this was warranted. Some stated that universities are "social" institutions and that the group's expertise is social-science based, while others saw this approach as too narrow in the face of the much-heralded "information age."

A third area of little clear consensus among the group involved the sources to be pursued. These disagreements involved not only the range of subject matter but also the degree to which the sources were primary (e.g., journal articles) as opposed to secondary (e.g., Berkeley campus newspapers, the Washington Post). For the latter, the risk is "old news," while for the former the costs can be prohibitive.

The respondents tended to endorse more intuitive approaches for selecting those issues which should be carefully tracked. While there was broad discussion of criteria (such as probability, impact, strategic opportunity or threat, degree of malleability, etc.) in its early months, the ETEA has thus far not developed formal decision criteria. One member suggested the group scan and track "the big things, whatever they are." Another suggested the ETEA focus on whichever issues have the potential to give busy university leaders "cause to pause."

Who Should Do the Assessing? There were three initial guiding hypotheses on this topic. First, conduct the effort openly and with representative

participation from various segments of campus life, i.e., do not ignore the political nature of the institution or the bias to equal participation rights among its constituencies. An aura of neutrality, tolerance of controversy and usefulness is important, both in picking the areas to be assessed and in actually assessing those areas. That aura will be difficult to achieve if environmental assessment is to be done solely by the university's planning staff. Second, take advantage of discipline-based environmental intelligence available on campus. It would be expensive and politically inexpedient to do otherwise (e.g., see Baldridge and Okimi, 1982; Cope, 1981a,b). Third, include the Public Affairs Office in the effort. These offices often subscribe to clipping services and have experienced readers of the political and social winds. What is more, the act of initiating formal environmental scanning may be perceived as a threat in those offices if they are not involved at the start.

The three hypotheses were not wholly supported by those interviewed. No one disagreed with the recommendation that Public Affairs staff be involved in the team, but the agreement with the recommendation of openness and representativeness was qualified. The sticking point involved not the advisability of openness but the definition of representativeness. There was a sense among some respondents that too much diversity, or size, could cause the group to collapse. Its voluntary nature might be too fragile to accommodate the inherent tensions or conflicts of diversity. Indeed, a second respondent suggested representativeness may be bought at the cost of suspicions regarding the reasons one has been invited. On the other side, some respondents strongly supported the idea of a formal, organizationally based representation scheme (e.g., inviting someone from each of the Vice Presidents' offices) and a more balanced mix of team members (as to race, age, gender, position, disciplinary background, and so forth).

There was also some disagreement as to the ways in which the group should employ faculty expertise. No one doubted its value, but a number of tradeoffs were raised. Several commented that ultimate responsibility for initiating and sustaining planning should lie with university planning and institutional research staff, thus their role should be central. The administrative user of the ETEA's products stressed that the data arm of the university, the office of institutional research, should be fully integrated into the environmental assessment effort. Its expertise and its tradition of "contracting" with faculty and others as sources of expertise should not be bypassed. This officer commented that the ETEA would ideally blend the energy and talent of faculty, as evidenced in the various committees of the University Senate, with the resources and stability of IR. Others commented that faculty need incentives to participate, particularly those who are not professionally interested in management and planning techniques. In a research institution, such incentives can be difficult to create. Also mentioned was the tradeoff between the high levels of political legitimacy that could be provided by senior faculty versus the greater time, energy, and even quality that might come with junior faculty.

This issue of junior versus senior team members was applied by some respondents to the staff participants as well. To the extent the group is seen as "the kids off playing," as one said, their efforts may be only tolerated bemusedly, rather than given serious attention. On the other hand, the energy and time demands on senior executives would constrain their efforts.

Regardless of the team composition, several respondents noted that it is important that those responsible for environmental assessment be people who are knowledgeable of the cultural and organizational characteristics of the university (its activities, people, "boundaries," etc.). Attention to broad categories

of team member characteristics (e.g., junior versus senior) should not supplant attention to this basic prerequisite for for membership.

Two "mixed" staffing ideas were suggested by the respondents. One involved using faculty only as "scanners." Serious tracking and monitoring of individual issues would be the province of the planning staff. A second suggestion involved supplementing the ETEA members' efforts by sending their products out to external review teams (e.g., corporate scanners, private consultants in the field). This is an approach used by Shell Oil Company to "calibrate" its inhouse environmental assessment efforts and thereby avoid internal biases.

How to Organize the Assessment Effort? For this question, four initial guiding hypotheses were proposed. First, instill a "bias to action" among those involved. Stressing the need for attention to arising environmental issues can be part of an effort to galvanize a "sleepy" or "hunkered-down" campus populace. Providing useful products early on can be an important element in the survival and success of a new assessment effort. Second, stress publicly the potential role of environmental assessment in preserving the institution and its traditions, as well as its potential role in bringing about major changes in direction. For example, concentrated monitoring may suggest actions that can save an ailing geography or classics department.

Third, begin environmental assessment on a modest, experimental level. Allow its initial successes and failures to determine its usefulness and format for future purposes at the institution. The voluntary team or task-force approach, with a fairly open-ended charge, may promote levels of creativity and commitment greater than those engendered by appointing committees or assigning job responsibilities. Fourth, to the extent possible, closely link the identification of core issues for assessment, scanning, and tracking. Because

the process of environmental assessment is rather wholistic, there should be continuity and connection among the core activities of assessment. Ideally, a "story" should result from the various "readings." Constructing that story is an act of art and intuition as much as technical competence. Unbundling the process into distinct parts of the institution or parts of the story can thwart success.

Diversity was expected and found in the responses of the interviewees to the "how to organize" question. The organizational issue had grown in salience over the first eight months as the ETEA moved from broad-ranging discussions into production and dissemination of its first report. There were no respondents who saw the group solely as a debating group, so the hypothesis regarding seeking to encourage a "bias to action" in the institution was generally supported. Several stressed that the urge for action should not always be slowed by feelings of "inadequate data." For the group, the value of the artistic, intuitive aspects of scanning and tracking, as well as strategy formation, outweighed the "inevitability of incompleteness and errors." The focus was on aiding university alertness and decisions.

Stressing the potential role of preservation as well as change clearly seems premature in the Minnesota setting. For the respondents, the more immediate political issue for the ETEA is establishing its legitimacy for any effective power whatsoever. After eight months the group has yet to threaten anyone as a potential source for real change, so it is far from a need to confront anyone regarding its potential for preservation.

The organizational underpinnings of political legitimacy were therefore a matter of concern for everyone in the ETEA as well as the administrative consumer of the group's products. While no one saw benefit in beginning the ETEA

on a more official, formally charged level, all agreed on the growing need for some "official blessing" and the designation of a somewhat more formal status. But the natural follow-up issue, i.e., whether the group should remain largely ad hoc and voluntary, was more disputed. The need for legitimacy seemed best met by formal representation schemes and a defined place within the organization's structure and standard procedures; but the need for energy, open-endedness, and quality seemed best met by a less obligatory, less defined end state. This tension was emphasized by several respondents, but few concrete suggestions for resolution were made.[7]

The possibility of working as an advisory group to the planning Vice President was mentioned by several respondents. There was, however, some reservation expressed about the political wisdom of incorporating the group entirely into the existing staff/job context of planning at the university. One respondent expressed a fear that total incorporation might lead the group to take on the unfortunate characteristics of the typical scanning office in the corporate world. She describes such offices as "a blaze of efficiency but a candle of effectiveness." Another said that the ETEA might grow to "take on the best aspects" of both a campus senate committee and a planning staff working group. In other words, the group might seek to combine the high levels of energy, creativity, autonomy, and legitimacy of a faculty group with the special expertise, continuity, and efficiency of an administrative team.

Whatever the balance of formal and informal in organizing the effort, several respondents noted that both the "bias to action" of the effort and its political legitimacy would be served by proximity to true decision making authority. For example, on a campus with faculty dominance in governance processes, the prospects for success in an environmental assessment effort may lie

in direct negative relation to the "organizational distance" of the effort from powerful faculty decision makers.

The fourth hypothesis suggested that the identification of broad environmental issue domains for scanning be closely linked organizationally to the actual activities of scanning and tracking. In other words, the organizational "processing" of an issue should proceed smoothly from a vaguely perceived threat or opportunity into a better known matter on which university leaders are informed. Whether the respondents accepted the notion of close linkage depends on how one defines "close." Some group members favored a partial decoupling, with faculty performing tasks of general issue of identification and scanning and staff playing key roles in translating the faculty work into particularized information gathering, systematizing, and weighting. One respondent mentioned that various staff are always involved in tracking certain issues, such as student aid funding developments and federal research contract regulations. Thus the real contribution of the assessment group might come not from removing some of this responsibility from staff but rather from providing it with less random organization and a broader grounding in likely future developments.

To the extent universities, like all organizations, have "slack" in the form of resources waiting to be directed (March, 1982), helping to inform the "future views" of strategic planners represents a use of slack that may be both organizationally distinct and valuable. Perhaps the proper role of faculty environmental assessors, the respondents hinted, lies in the special charge of helping to "position" the university for the future. The details of creating a strategy may best be left to administrators.[8]

Emerging from the interviews was a global concern for organization which linked a number of the hypotheses. Several of the respondents focussed upon the

interrelated issues of who sets the agenda of the environmental assessors, what form of external input is appropriate, and what channels should be followed procedurally for the products of the group? One ETEA member suggested the group independently set its agenda of critical issues, then produce products which form the basis for upper-level administrator feedback into the group. Thus the products are to be revised to fit specific organizational needs, but the agenda is to be formed outside of the dominant world view of administrative leadership. Another team member saw this level of team autonomy in agenda-setting as a liability in establishing organizational legitimacy and stressed a need for closer ties to pragmatic, action-oriented administrators. Allowing the Vice President for Planning to set the team agenda, he argued, would more effectively integrate and utilize the team's efforts. The general tone of the group responses seemed to favor the more autonomous course, but the question remains open. On the question of what procedural channels should be constructed for group products, there were fewer differences among the group, but a clear sense that this issue deserved more attention. Would the channels be routinized as standard operating procedures or determined ad hoc depending on the particular subject matters being addressed? This question will likely occupy greater ETEA time in the forthcoming months.

What to Produce? Two initial hypotheses were formulated regarding the ideal products of the assessment effort. First, produce products oriented to administrative/governance usefulness. The products should be accessible to busy people. The ultimate form of the products should be dictated by the usefulness criterion, as applied to the issue at hand. If a written product is appropriate, bear in mind that the crisp executive summary, not the footnoted rationale will be the most visible and most used product. Regardless of whether

an issue's presentation is best done in written or oral form, that presentation should tell an understandable, believable story, and inspire faith in the more detailed analysis that lies behind it. Usefulness should be broadly defined (for example, relevance for administrators' short-term decisions is not always essential for a product to be seen as useful). Second, orient products to the specification of facts and alternatives, not to action recommendations. The ideal role of the assessors may be viewed as similar to that of the Congressional Budget Office in Washington: determinedly neutral advisors to the governance process, at the service of all parties to that process.

The question of what to produce occupied a good deal of attention in the interviews and in ETEA meetings. The one written product of the group, the report on animal rights, "happened" rather than evolved as part of a comprehensive strategy on products. Nevertheless, this report had some important traits: the issue had immediate implications; the report was short; it was clearly reflective of a growing trend; and it provided information that might not otherwise reach leaders' hands (e.g., summaries of action taken on other campuses). Importantly, although the report did not recommend "the best" way to manage the animal rights issue, it did outline several action options for administrators addressing the issue.

The report met the criterion of usefulness. There were several interrelated schools of thought, however, as to whether focussing on such specific issues as animal rights reports should represent a standard for the group. For some respondents, the critical criterion seemed to be that the products help leaders avoid the oversights and errors of the past, such as the twin mistakes of the late sixties and seventies (not seeing the "baby bust" early on, and not realizing the significance of the budding women's rights movement). As one

respondent commented, environmental assessment should provide products that give the University "a mirror on its unconscious prejudices." Such products could be specific or general in focus. Other respondents stressed the need for specific products that directly shape organizational behaviors. Such products should outline how developing issues will act on the organization, by way of detailed analysis of the organization's central constituencies, its various structures, and its various processes (for an example of this perspective, see Matross, 1983).

Regardless of their views on specificity, through, several respondents suggested that useful products need not cause behavioral change. Instead, the basic goal for a product should be to lead to either behavioral change or a conscious decision not to change. Raising the consciousness of leaders regarding an issue is thus the bottom line for evaluating scanning and tracking efforts.

Respondents unanimously felt that scanning and tracking products, even if focussed on eminently disruptive events, should blend short-term issues with longer-term concerns. One group member commented that the products which will be most appreciated (those with a short-term, pragmatic approach) may be distinct from those which are most useful (those with a longer term, strategic approach). Another commented, "A successful scanning effort will balance short-term, utilitarian products with longer-term, broad efforts. Scanning to set the context for planning will require a broad vantage point; issues management may more frequently focus on short-term decisions."

When the interviews turned to the ideal nature of "useful products," the respondents were generally oriented toward "letting a thousand flowers bloom." Among the ideas generated were a campus-wide convocation, trend analysis newsletters, brief emerging issue reports, the pursuit of "jazz and flash" in various kinds of reports and presentations, bi-annual seminars for top

administrators, and off-campus retreats for leaders and environmental assessors. Several ETEA respondents mentioned the need for the products to be both informative (not duplicating other information already widely available on campus) and modest in tone, reflecting as necessary the team's lack of expertise or lack of monopoly on expertise regarding an issue at hand.

There were also several statements in favor of fitting products to the specific user audience and issue at hand. This point is supported by the practice at Honeywell corporation, where regular issue reports have evolved to a lean, informative style devoid of unnecessary words. For example, in reports regarding developments in federal legislation, no bill numbers, committee names, Congressmember names, or detailed quantitative specifics appear. Only the necessary information core is disseminated (Bright and Heer, 1984).

A more radical approach to "useful" products is to consider the process of environmental assessment itself to be the central product. Regarding higher education planning in general, this point has been made by several analysts (see Cope, 1981b; Cohen and March, 1974; Baldridge and Okimi, 1982; various chapters in Jedamus and Peterson, 1980). One team member suggested that, by turning around ideas and challenging various perspectives on the world, the ETEA group's dialogues reintroduced a long lost and much valued ingredient into the current university. Many staff and faculty are trained to think in such terms, but few receive incentives to do so in their everyday work. Moreover, if employee satisfaction and growth may be considered aspects of organizational effectiveness, as suggested by Cameron (1978), then environmental assessment may be defensible in and of itself, regardless of its utility for meeting other organizational objectives. However, the danger of environmental assessment which functions as no more than an outlet for staff needs is its capacity to spawn what one ETEA

member called "an articulate but frustrated intelligentsia," producing much talk but prompting little organizational change. Environmental assessment could become a sterile, marginal exercise. The usefulness of such an outcome seems questionable.

The second product hypothesis called for the summary of information and facts, not recommendations for action. The responses of the ETEA members and the outside administrative "consumer" diverged somewhat on this hypothesis. The group members tended toward a more neutral posture, whereas the senior administrator tended toward a more activist approach. Nevertheless, all seemed reasonably content with the middle approach (products providing a listing and discussion of options available to administrators for dealing with a developing trend or issue). Indeed, this was the approach followed by the ETEA in its one written report.

Evaluating the ETEA: As presented earlier, the primary objectives of ETEA were to embrace uncertainty and thereby to 1) inform the President's institutional planning activities, 2) provide background information for institutional planning themes and task forces, 3) expand the perspectives of university planners, 4) reduce the chances of overlooking critical issues, and 5) produce environmental scenarios to aid planning. In the opinion of the authors and all of the respondents, eight months is far too short a life span to allow definitive conclusions regarding the effort's performance on these criteria.[9]

Respondents were therefore quite tolerant of the group's lengthy debates on process and substance, and its not having produced much written output in its first eight months. Attendance and enthusiasm in February were as high as in the ETEA's first months. In meetings in January and early February, however, gentle pressure began to mount within the group for closure on some methodological

issues. Good-natured ribbing about the group's progress became a bit more frequent, as did friendly pleas for greater structure.

If the group were ranked on its performance thus far on the five objectives, it would receive its highest ranks on objectives 3 and 4, somewhat lower rank for objective 2, and "incompletes" for objectives 1 and 5. Since these objectives are unchanged, the extent to which the ETEA can erase the "incompletes," improve on objective 2, and maintain and improve performance on objectives 3 and 4 will play a major role in determining its future.

Evaluative Summary: Critical Tensions in Environmental Assessment

Organizational tensions regarding environmental assessment at the University of Minnesota seem to be revolving around twelve concerns. These concerns may be presented as sets of opposed decision alternatives. To the extent the institution bends in one direction in acting on a concern, it encounters one vector of benefits and costs. To the extent it bends in the opposite direction, it encounters a distinctly different vector of benefits and costs. These critical concerns are highlighted below. Each is drawn from the results presented above.

- Tension 1: Credibility versus Quality. The potential environmental assessors with the greatest organizational credibility and legitimacy may not be the same as the potential environmental assessors with the greatest degree of commitment, energy, and creativity to provide to the effort.

- Tension 2: Issue Management versus Issue Identification and Analysis. To the extent assessors orient themselves to recommending specific actions they bend away from the more neutral, passive role of analytic staff and into the politically charged arena of organizational decisions. Team composition, structure, process, and prospects are closely tied to this choice.

- Tension 3: Interpretation versus Information. A number of authors have argued that managers most need interpretations of the organizational context, not comprehensive, structured summaries of organizational data. The

"artistic" aspects of environmental assessment in an unpredictable world demand it involve interpretation, yet "rational" management may prefer a "just the facts" approach.[10]

- Tension 4: Diversity versus Homogeneity. There are clear benefits in making environmental assessment teams representative not only of different sociocultural backgrounds but also of different areas of professional competence. Yet, a diverse array of viewpoints may obstruct group productivity to such an extent that no products are forthcoming.

- Tension 5: Voluntary Participation versus Staff Assignment. The ETEA has benefited appreciably from voluntary participation. Team members brought with them enthusiasm and commitment that might not be present if they had been assigned this task. Yet, when forced to compete with formal job responsibilities, scanning and tracking have fallen low on people's priorities when allocating their time.

- Tension 6: Groups versus Individuals. The ETEA differs from its predecessor efforts at the University of Minnesota in its group focus. Earlier efforts were more individual, contracted at the request of top administrators. Group process can be slow, particularly on open-ended tasks such as environmental scanning; but it can also be creative and synergistic. The choice of approach depends on administrator preferences and constraints.

- Tension 7: Passive versus Active Attention. Issues growing slowly in importance are not noticed as much as those growing swiftly. Strategic planning drives out strategic thinking. Management information systems drive out truly valuable information. These are some of the organizational nightmares mentioned frequently by analysts of organizational innovation and change (Van de Ven, 1983; March, 1982). A central challenge to environmental assessors is creating incentives for active attention in a context that may well be programmed for passivity. As Van de Ven has stressed (1983), a critical problem of innovation and change is "the management of new ideas into good currency." Doing so requires leadership that is not only technologically adept (i.e., able to place the change in an effective organizational context for maximum efficiency), but also institutionally adept (i.e., able to integrate the change into longstanding institutional myths, traditions, rituals, beliefs, cultures, and so forth).[11]

- Tension 8: Process versus Products. To the extent an environmental assessment effort is conducted with the continuing and active participation of top leaders, that effort can afford to focus on process, i.e., debates, interactive presentations, and so forth. To the extent the effort proceeds independent of top leaders, "tangible products" such as reports, newsletters, and lectures may become more necessary. The more the effort must rely on products rather than process, the less likely it is to be an integrated element in strategic decision making.

- Tension 9: "Big" versus "Small". When environmental assessment efforts consider the more global and abstract aspects of the institutional envi-

ronment (such as the "information revolution"), the efforts take on an abstract, speculative quality. While these considerations may indeed be the special and valued province of environmental assessment, arguments can be made in favor of taking on smaller, more manageable chunks of reality. The latter approach may be more accepted by leaders and more amenable to coherent interpretation and decisions.[12]

- Tension 10: Centralized Strategy versus Centralized Coordination. Despite the recent spate of articles and books lauding and encouraging the strategic revolution in American higher education, the jury is still out on the substantive promise of this approach (see Baldridge and Okimi, 1982; Dill, 1982). Clark (1983) has argued that organizational factors strongly determine the fate of ideas and reforms in higher education, and an organizational model in which the center holds and the top dominates does not fit academic organizations well. Clark's work implies that the decentralized, loosely-coupled nature of American universities may in fact be central ingredients in productivity and progress in research, teaching, and service. Thus the potential of environmental assessment may be measured by the degree to which it can be adjusted to fit the disparate predilections of powerful academic units while not foregoing a healthy orientation to the good of the institution as a whole.

- Tension 11: Governance versus Management. To date, the University of Minnesota assessment experience has been tilted to the "managers" of the institution, not the "governors," i.e., the University Senate. As such it is most closely attached to those concerned with issue management and least attached to those involved in determining an overall policy approach. There are inevitable benefits and costs attached to this approach.

- Tension 12: Tight, Direct Connections versus Loose, Indirect Connections. The channels and couplings associated with environmental assessment efforts are central to the fate of such efforts within the organization. The challenge to leaders valuing this activity is to connect the efforts to other parts of the organization productively. These connections involve matters of team membership, team process, product channels, feedback loops, sponsorship, composition, and authority delegation. The construction of appropriate channels and couplings is no easy matter. As Van de Ven (1983) has suggested, impeccable logic in connections at the micro-level in an organization may lead to nonsense logic at the macro-level.

## Implications

The experimental environmental assessment effort at Minnesota is in its infant stages. Its longer term results will be significant in several respects. First, they will provide some tentative guidance as to whether such an effort is generally warranted in research universities. Of course, the results will not

be precise enough to dictate yes/no answers to the question for any institution in any situation. As Clark (1983), Keller (1983), and numerous others have stressed, the degree of organizational diversity in American higher education is remarkable. Even when restricting the sample to research universities, institutions vary tremendously in the degree to which they represent fertile ground for strategic innovations like formal environmental assessment. Nevertheless, the results from Minnesota will be useful as first approximations.

Second, these long term results will hint at the more useful and less useful organizational structures and processes for environmental assessment in universities. The discussion above of results and tensions highlights the major stances taken in the earliest months of the Minnesota experiment. These decisions may come to be the ground on which the effort eventually stands or falls. Whatever the fate of the Minnesota work, lessons will be learned.

Third, the long-term results will provide guidance as to the specific kinds of environmental assessment best done in university settings, and the kinds best left to outside agencies. Consulting organizations doing scanning are becoming plentiful, but some authors have suggested the novel possibility of national or regional consortia of postsecondary institutions for scanning (e.g., see Cope, 1981a,b). Along those lines, one institution could take the lead, selling its efforts to other similar institutions. Alternatively, a group of institutions could arrive at a division of labor, segmenting and parceling out different aspects of scanning and tracking. It would seem such an idea might be most appropriate for broader objectives, such as the production of a probability/diffusion matrix or a value profile for various events or trends. Integrating such efforts into strategic objectives might best be conducted at the institutional level.

Fourth, on a more theoretical level, the longer term results will provide evidence for organizational analysts on the methods and effectiveness of environmental assessment in loosely-coupled, politicized, professional organizations. A number of concerns have been raised in this paper regarding the composition and context of environmental assessment teams. It remains to be seen whether these significant tensions can be dealt with effectively or whether the historic qualities of academic organizations will frustrate yet another organizational import from the corporate sector.[13]

In sum, the short-term results presented here are in many ways preludes to the ultimate evaluation of the Minnesota experiment. They nevertheless are significant along the several fronts outlined above. If the organizational power, energy, and talent of those oriented to environmental assessment are not sufficient to allow them to establish and defend an initial organizational niche from which the effort may be nurtured, then the longer term issues of technique and eventual benefits are moot. Therefore, it seems clearly worthwhile to engage in ongoing analysis of the process, products, and roles of formal environmental assessment as it evolves.

## FOOTNOTES

1. The literature of education is full of references to the institutional "environment," but this literature tends to define the term as the internal social climate of the institution, rather than its external context (see Moos, 1979, Astin, 1968). Except where otherwise noted, this paper uses the term as it is usually used in general organization theory, i.e., to refer to the external context of the institution.
2. Two clarifications of meaning are necessary here. First, the use of the term "experiment" here is, of course, not meant to imply a formal experiment in the scientific sense. Rather, what is intended is a more colloquial sense of an experiment, i.e., a trial endeavor in an organization. Second, the phrase "environmental assessment" is used in this paper to include both environmental "scanning" and environmental "monitoring" or "tracking." The literature is divided over whether "scanning" includes "tracking" and "monitoring." We see these as somewhat distinct activities, so we employ "assessment" as the inclusive term in the paper.
3. These four focuses (society, technology, economy, and polity) have often been suggested as the ideal organizing breakdown for environmental scanning efforts. This "STEP" approach is reviewed in a number of sources (for example, see Cope, 1981a,b).
4. The group as described here is the group which conducted the great majority of the work of the experimental team. Others (some of higher administrative and faculty rank) drifted in and out, particularly at the beginning of the process. This fluid, but valuable, participation largely disappeared after about two months.

5. For evidence of press attention to the issue, see The Washington Post (November 13, 1983), The Chronicle of Higher Education (September 7, 1983), Science News (July 20, 1983). The ETEA report itself (Ad Hoc Team on Environmental Assessment, October 31, 1983) is available upon request to the authors. The report was issued under the authorship of the "Ad Hoc Team" rather than the "Experimental Team," but that choice was temporary and reflected only a change in name, not substance.

6. The public information officer within the group buttressed this point by way of a strikingly ironic example regarding the difficulty of anyone "knowing" a giant univer ity. It seems that many large institutions use major national news media (e.g., The New York Times, The Washington Post) as a main source of information regarding their faculty members and researchers. Having found formal mention of campus research project in such a source, university administrative staff then contact the principals in the research in order to write their own stories regarding the research for the faculty-staff newsletter, the alumni bulletin, and so forth. On such campuses, attempts by administrators to learn of significant local research otherwise (e.g., through surveys of those doing research on campus) have proven largely nonproductive due largely to lack of consistent, full cooperation. Thus some might argue that far from being able to look "in" in order to see "out" (i.e., to see the environment), universities may in fact be oftentimes forced to look "out" in order to see "in."

7. According to a number of analysts, including Cohen and March (1974) and Baldridge and Okimi (1982), a willingness to embrace error and learn from it, rather than avoid it or cover it up, is a very healthy goal for administrative leadership on campus. The experimental and open ended nature of groups like ETEA may foster such a willingness, at least among their participants.

8. This division of task and personnel regarding organizational/environment relations has been placed in a more theoretical context by Bourgeois (1980). He argues that the environment of an organization may be categorized into the "general environment" (the broad outlines of culture, economy, polity, etc.) and the "task environment" (the parts of the environment relating to the specific current products of the organization). Organizational strategy may likewise be categorized into primary strategy (selection of the domains for primary efforts) and secondary strategy (competitive approach). Bourgeois blends these two categories by suggesting that primary strategy is most concerned with the general environment, whereas secondary strategy is most concerned with the task environment. In the context of the university, the predilections and skills of faculty in their governance role may fit most closely into the primary strategy/general environment nexus.

9. Evaluation of the ETEA is also made more difficult by the indeterminacy of the criteria for effectiveness. Not only has there never been an environmental assessment team before at the University of Minnesota, there has never been devised a solid method for measuring the contributions of such an effort to ongoing planning. For example, what issues would have been missed without it? There is currently no defensible way to answer such a question.

10. For example, James March (1982, page 9) has stated, "If management is seen less as choice and more as discovering new objectives, developing myths and interpretations of life, and modifying the diffuse beliefs and cultural understandings that make organizational events comprehensible and life enjoyable, then it is not obvious that the best management information system is a decision support system. Intelligent managers might pay more for, and attend more to, a system designed to develop interpretations of events and understandings of history rather than to help make choices." Peters and Waterman (1982), present a similar argument.

11. Related points have been raised by Dill (1982). He argues, however, that academic culture is largely inhospitable to the "strategic" orientation, and sees little hope for the effective integration of the two.

12. For more on this point, see the intriguing discussion of "small wins" by Weick (1984) and Baldridge's (1980) discussion of "rules" for successful implementation of innovations in political institutions.

13. A number of authors have commented upon the difficulties of implementing information systems and forecasting models in higher education institutions, despite the relative acceptance and productivity of those kinds of systems and models in other settings (see Schmidtlein, 1977; Kirschling, 1976; Bloomfield and Updegrove, 1981; Masland, 1983).

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